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(54) Drive axle assembly for motor vehicle having a double clutch actuated by the same actuating force

(57) A drive assembly for a motor vehicle, comprising a first drivable axle in permanent driving relationship with a drive unit, a second drivable axle connectable into driving relationship with the drive unit by way of a controllable double coupling assembly, the double coupling assembly comprising a carrier member (6), a common set of first friction plates (15, 16) and individual sets of further friction plates (17, 18) connected respectively to output members of the second axle, an actuating device (25) being provided common to all the plates of the double coupling so that they can all be brought into driving engagement by the same actuating force.

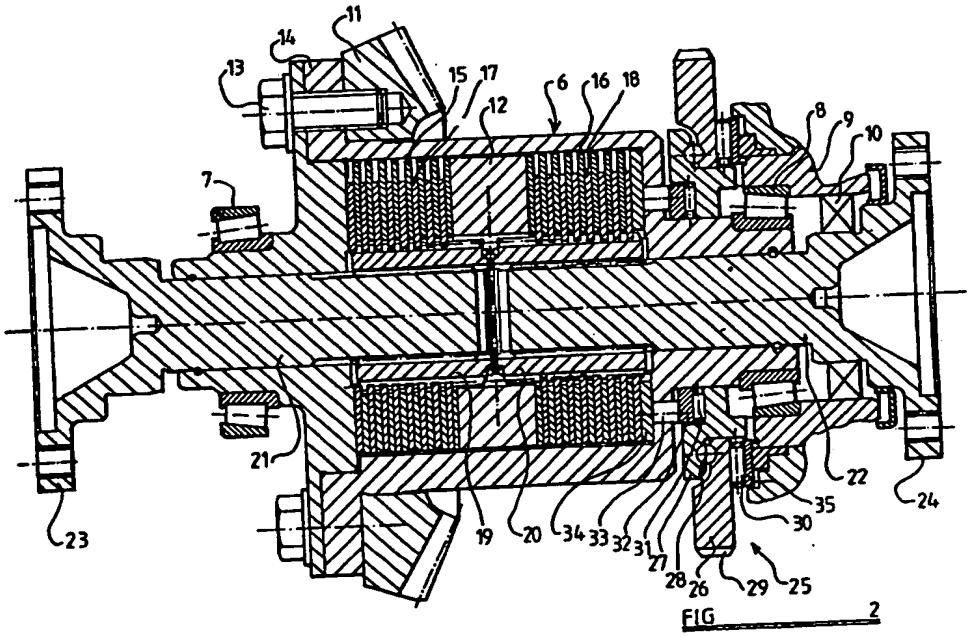

FIG 2

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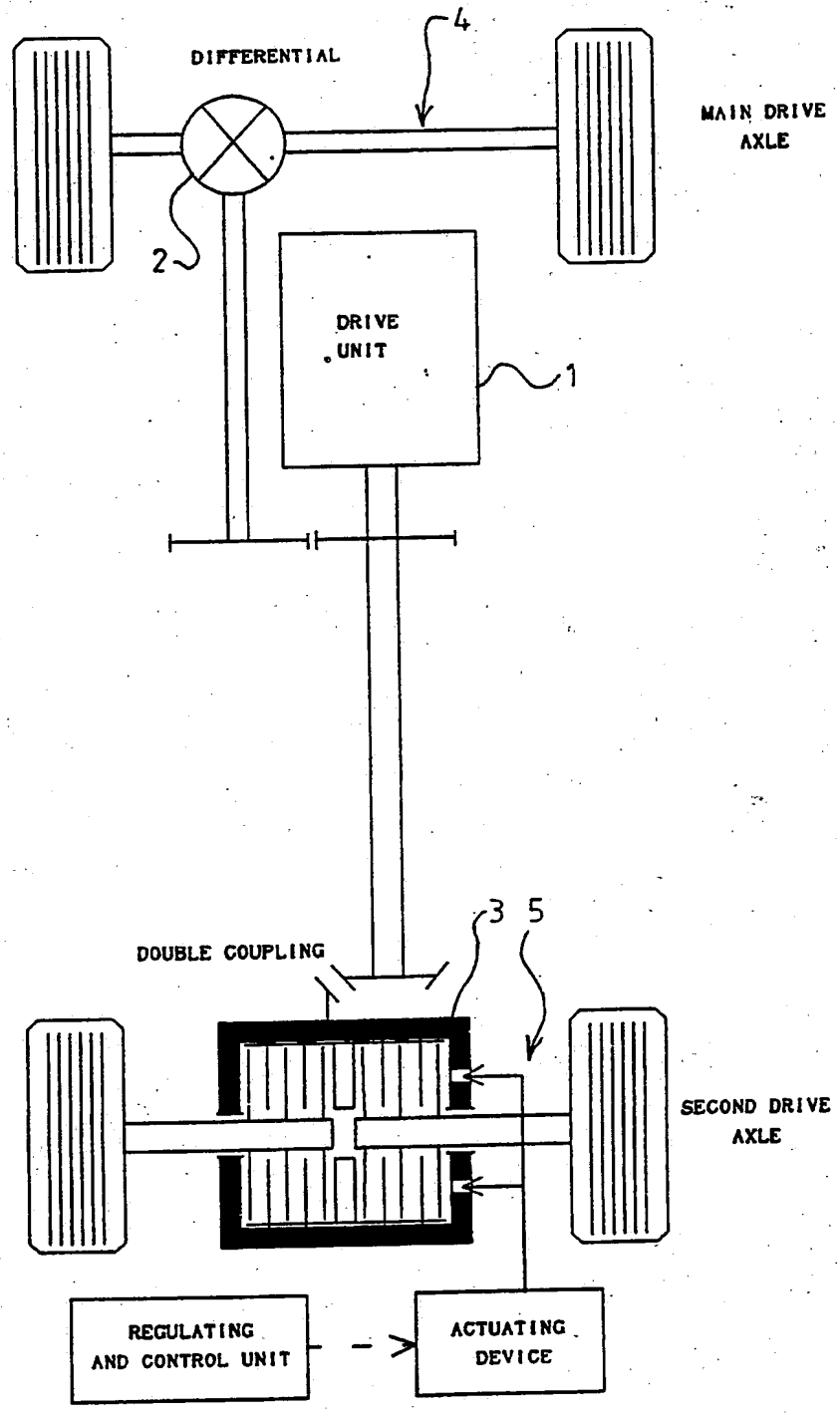
DIFFERENTIAL
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MAIN DRIVE AXLE
2
DRIVE UNIT
1
3
5
DOUBLE COUPLING
SECOND DRIVE AXLE
REGULATING AND CONTROL UNIT
ACTUATING DEVICE

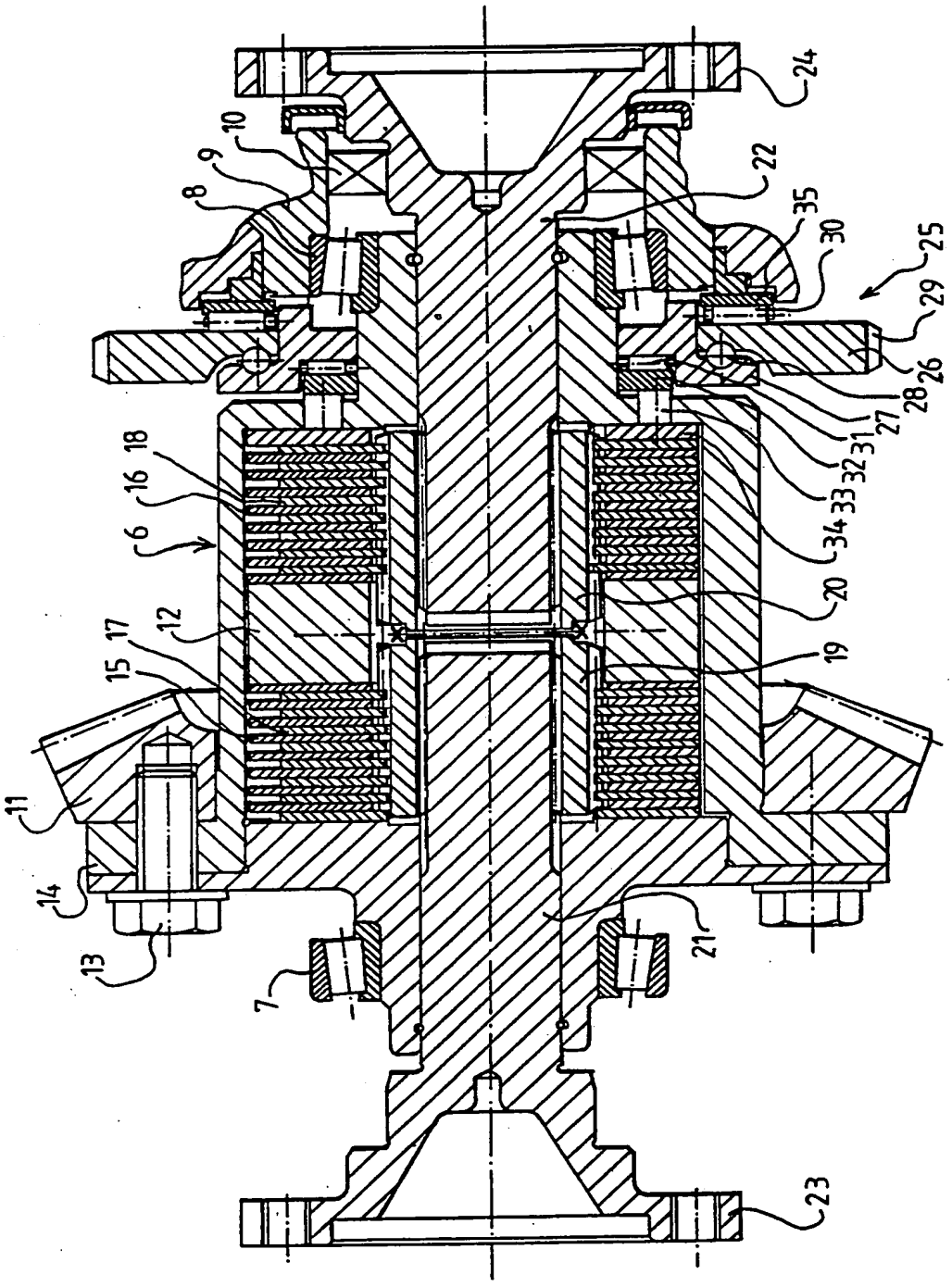
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FIG 2

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Title: Drive Assembly for Motor Vehicle

This invention relates to a drive assembly for a motor vehicle, comprising a first drivable axle in permanent driving relationship with a drive unit of the vehicle and at least a second axle connectable into driving relationship with the drive unit by way of an externally controllable double coupling assembly, the double coupling assembly comprising a drivable carrier member having a set of first plates and individual sets of further plates connected respectively to output members of the second axle.

DE-U1-88 07 664.4 proposes a drive assembly in which each drivable axle comprises a double coupling assembly and which, consequently, permits torque distribution between the axles without use of a differential gearing. The double coupling assemblies in the axles are each provided with an independent actuating assembly for bringing each set of further plates of the coupling assembly into driving engagement. Thus it is possible to control the distribution of torque between the axles as a function of the vehicle operating conditions: in particular, the intention is to take steering angle into account.

DE-38 13 305 A1 discloses a double coupling assembly for a vehicle drive arrangement, in which two sets of plates are controlled by a common actuating assembly.

In view of the fact that the first drive assembly above described involves complicated control mechanisms, it is the object of the present invention to provide a drive assembly of that type which is of simpler design and requires a simple control mechanism, able to give the characteristic that the second axle is in driving connection only temporarily and when required. The use of simple components is required.

The invention therefore provides that the double coupling is arranged to be actuated by an actuating device common to both the sets of further plates

so that they can both be brought into driving engagement with the first set of plates by the same actuating force.

In this way it is possible to eliminate the requirement for a central differential, and yet provide a second drivable axle of the simplest possible design, but which nevertheless prevents any torsional wind-up in the driveline when corners are being negotiated and also the disadvantageous switching jerk or jolt which is produced in the vehicle's driveline when releasing the second axle from being driven, for example when braking. The permanently driven first axle may be provided with a mechanical differential as generally known hitherto: such a differential may have a self locking or slip limiting function. The carrier member of the second axle is permanently driven by the drive unit.

The common actuating device for both the further sets of plates of the double coupling in the second axle may operate by any suitable principle, e.g. hydraulic, pneumatic, electric or electro-magnetic.

An actuating device for the double coupling which is particularly advantageous, being of simple design and easy to control, comprises a mechanical mechanism in the form of two disc elements movable angularly relative to one another, rolling members being disposed between the disc elements and engaging guiding tracks which are of changing depth as they extend in opposite directions circumferentially of the disc elements. Thus, upon angular movement of one of the disc elements relative to the other, an axial movement is caused of one of the discs, to act on the sets of plates.

Such actuating devices have already been proposed in connection with differential locks. The characteristics of the actuating device may be non-linear, especially degressive to provide a decrease in the rate of axial movement of one of the disc elements as a function of the angular movement between the discs.

The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 shows diagrammatically a vehicle driveline arrangement incorporating the invention;

Figure 2 is a longitudinal section through a double coupling assembly used in the driveline.

Referring firstly to Figure 1, the vehicle driveline illustrated has a main drive axle 4 and a second drive axle 5. The vehicle has a drive unit (engine and gearbox) 1 from which a driveshaft extends to a centre coupling unit from which further driveshafts extend respectively to a differential 2 in the main drive axle and to a double coupling 3 in the second drive axle. The differential 2 in the main drive axle is a conventional mechanical differential, and may provide locking or limited slip characteristics. The double coupling unit 3 in the second drive axle is shown in greater detail in Figure 2, and includes an actuating device which is controlled by a regulating and control unit.

Referring now to Figure 2, the double coupling 3 comprises a carrier 6 which is rotatably supported in a casing, part of which is shown at 9, by bearings 7, 8. The carrier 6 is in two parts bolted together at facing flange formations 14 by a plurality of bolts 13, the bolts also securing a crown wheel 11 to the carrier for driving the latter by gears from the driveshaft which extends to the double coupling.

Within the carrier 6 are disposed two groups 15, 16 forming a first set of friction plates rotatably fast with the carrier and axially movable relative thereto, a spacer 12 being disposed between the two groups of plates. Interleaved with the plates of the groups of plates 15, 16 respectively are two sets of further plates 17, 18 which are rotationally fast with and axially movable relative to output sleeves 19, 20 respectively, The sleeves 19, 20 have torque-transmitting engagement by splines with output shafts 21, 22 which extend outwardly from the casing of the double coupling unit and are provided with drive flanges 23, 24 respectively. The drive flanges 23, 24 provide for torque transmitting connection to halfshafts leading to the wheels of the second drive axle. Visible in Figure 2 is a seal 10 where the output shaft 22 extends outwardly from the casing 9 of the double coupling.

Within the casing of the double coupling there is provided an actuating mechanism indicated generally at 25. This comprises an annular disc-like abutment element 26 which is disposed concentric with the carrier 6 and abuts the casing 9 through the intermediary of a thrust bearing 30, 35. The abutment plate 26 is movable angularly within the casing by a driving device engaging gear teeth 29 provided on its periphery. Facing the abutment element 26 is an actuating disc element 27, and a plurality of rolling elements in the form of balls are disposed between the abutment disc element 26 and actuating disc element 27. The balls 28 engage in circumferentially extending tracks in the elements 26, 27, the depth of the tracks changing as they extend in opposite directions. The actuating disc element 27 is secured against angular movement within the casing but is movable axially, and is operable on a pressure plate 32 through the intermediary of a thrust bearing 31. The pressure plate 32 engages tappets 33 which extend axially through the carrier 6 and in turn engage a pressure plate 34 within the carrier, the pressure plate 34 bearing on the plates within the carrier.

Thus, angular movement of the abutment disc element 26 in the appropriate sense causes axial movement of the actuating disc element 27 which movement is transmitted to urge the plates 15, 16, 17, 18 into frictional engagement with one another. All the plates are brought into such engagement with the same force. This provides for driving connection of the wheels of the second drive axle to the drive unit of the vehicle when required, which driving connection is readily discontinued when the vehicle operating conditions do not require it.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A drive assembly for a motor vehicle, comprising a first drivable axle in permanent driving relationship with a drive unit of the vehicle and at least one second axle connectable into driving relationship with the drive unit by a controllable double coupling assembly; the double coupling assembly comprising a drivable carrier member having a common set of first plates, and individual sets of further plates frictionally engagable with the first plates and connected respectively to output members of the second axle, wherein there is provided an actuating device common to both sets of second plates and arranged to bring them into driving engagement with the first plates by the same actuating force.

2. A drive assembly according to claim 1 wherein the actuating device comprises two disc elements angularly movable relative to one another and provided with tracks engaged by rolling members disposed between the disc elements, the tracks being of changing depth in opposite directions circumferentially of the disc elements so that said relative angular movement thereof causes an axial movement of one disc element, to act on the sets of plates.

3. A drive assembly according to claim 2 wherein said disc elements comprise a first disc element movable angularly relative to a casing of the double coupling and axially supported relative thereto, and an axially movable disc element held against rotation relative to the casing.

4. A drive assembly according to claim 2 or claim 3 wherein the tracks wherein the rolling members are engaged have a non-linear change of depth as they extend circumferentially of the disc elements.

5. A drive assembly according to claim 4 wherein the characteristics of the actuating device are degressive.

6. A drive assembly substantially as hereinbefore described with reference to the accompanying drawings.

7. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

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